

CLAIMS

1. A circuit assembly comprising a substrate and a surface-mount device mounted thereto, multiple electrically-conductive pads present on at least one device attachment region of the substrate, and solder joints bonding the surface-mount device to the pads, the at least one device attachment region and a second region of the substrate being formed of a first material, the surface-mount device comprising a package formed of a second material having a lower coefficient of thermal expansion than the first material, the substrate having at least one aperture formed therein that is located and configured so as to cause at least a portion of the at least one device attachment region to be more compliant than the second region of the substrate.
2. The circuit assembly according to claim 1, wherein the at least one aperture comprises first and second apertures, the first and second apertures delineate first and second compliant members, respectively, within the at least one device attachment region of the substrate, and at least some of the pads are located on the first and second compliant members.
3. The circuit assembly according to claim 2, wherein each of the first and second apertures is U-shaped in the plane of the substrate.
4. The circuit assembly according to claim 2, wherein each of the first and second apertures is C-shaped in the plane of the substrate.
5. The circuit assembly according to claim 2, wherein the first and second compliant members have peripheral borders delineated by the first and second apertures, respectively, and each of the first and second compliant members has a boundary that is not delineated by the first and second apertures.

6. The circuit assembly according to claim 5, wherein the boundaries of the first and second compliant members face each other so that a central region of the at least one device attachment region is between the first and second compliant members.

7. The circuit assembly according to claim 6, further comprising a third aperture in the central region of the at least one device attachment region.

8. The circuit assembly according to claim 7, wherein the third aperture extends into each of the first and second compliant members separated by the central region.

9. The circuit assembly according to claim 7, wherein the third aperture has a substantially rectilinear shape in the plane of the substrate.

10. The circuit assembly according to claim 7, wherein the third aperture has a substantially circular shape in the plane of the substrate.

11. The circuit assembly according to claim 2, further comprising conductive runners that electrically interconnect the pads on the first and second compliant members to the second region of the substrate.

12. The circuit assembly according to claim 11, wherein at least one of the conductive runners extends along a surface of the substrate between the first and second apertures.

13. The circuit assembly according to claim 11, wherein at least one of the conductive runners extends along an edge of one of the first and second apertures.

14. The circuit assembly according to claim 2, wherein the first and second apertures are filled with an electrically-nonconductive material that differs from the first and second materials.

15. The circuit assembly according to claim 1, wherein the at least one aperture comprises multiple apertures, a first set of the multiple apertures delineates a first compliant member within the at the least one device attachment region of the substrate, a second set of the multiple apertures delineates a second compliant member within the at the least one device attachment region of the substrate, and at least some of the pads are located on the first and second compliant members.

16. The circuit assembly according to claim 15, wherein each of the multiple apertures is discrete and circular-shaped in the plane of the substrate.

17. The circuit assembly according to claim 15, wherein a central region is defined by and between the first and second compliant members within the at least one device attachment region.

18. The circuit assembly according to claim 17, further comprising at least one central aperture in the central region of the at least one device attachment region.

19. The circuit assembly according to claim 1, wherein the at least one aperture comprises at least three apertures aligned in a row, first and second apertures of the at least three apertures are adjacent and delineate a first compliant member therebetween within the at the least one device attachment region of the substrate, the second aperture and a third aperture of the at least three apertures are adjacent and delineate a second compliant member therebetween within the at the least one device attachment region of

the substrate, and at least some of the pads are located on the first and second compliant members.

20. The circuit assembly according to claim 19, wherein each of the at least three apertures is discrete and oblong-shaped in the plane of the substrate and in a direction transverse to a direction in which the first, second and third apertures are aligned.

21. The circuit assembly according to claim 19, wherein each of the first and second compliant members has opposing peripheral borders delineated by the at least three apertures, and each of the first and second compliant members has opposing boundaries that are not delineated by the at least three apertures so as to be contiguous with the second region of the substrate.

22. The circuit assembly according to claim 21, wherein the first and second compliant members are separated by the second aperture.

23. The circuit assembly according to claim 22, wherein the first, second and third apertures are substantially equal in shape and size.

24. The circuit assembly according to claim 22, wherein the first, second and third apertures are substantially equal in shape, the first and second apertures are substantially equal in size, and the third aperture is wider than the first and second apertures in a direction in which the first, second and third apertures are aligned.

25. The circuit assembly according to claim 22, wherein the first and second apertures are U-shaped in the plane of the substrate so that the peripheral borders of the first and second compliant members are U-shaped in the plane of the substrate and the boundaries of the first and second compliant

members face the third aperture, and the third aperture has two oppositely-disposed U-shaped edges facing the first and second apertures.

26. The circuit assembly according to claim 25, wherein the first and second apertures are substantially equal in shape and size, and the third aperture is wider than the first and second apertures in a direction in which the first, second and third apertures are aligned.

27. The circuit assembly according to claim 19, further comprising conductive runners that electrically interconnect the pads on the first and second compliant members to the second region of the substrate.

28. The circuit assembly according to claim 1, wherein at least one aperture comprises an S-shaped aperture, first and second portions of the S-shaped aperture delineate a first compliant member within the at least one device attachment region of the substrate, the second portion and an adjacent third portion of the S-shaped aperture delineate a second compliant member within the at the least one device attachment region of the substrate, and at least some of the pads are located on the first and second compliant members.

29. The circuit assembly according to claim 28, wherein each of the first and second compliant members has peripheral borders delineated on three sides by the S-shaped aperture, and each of the first and second compliant members has a boundary that is not delineated by the S-shaped aperture so as to be contiguous with the second region of the substrate.

30. The circuit assembly according to claim 29, wherein the first and second compliant members are separated by the second portion of the S-shaped aperture.

31. A circuit assembly comprising:

a substrate formed of a first material and comprising a device attachment region and a second region outside the device attachment region;

first and second slots formed in the substrate so as to be separated by the device attachment region, the first and second slots being substantially U-shaped in the plane of the substrate and delineating first and second compliant members, respectively, within the device attachment region, the first and second compliant members having oppositely-disposed peripheral borders delineated by the first and second slots, respectively, the first and second compliant members having boundaries that are not delineated by the first and second slots and are spaced apart by a central region of the device attachment region between the first and second compliant members, the first and second compliant members being more compliant than the second region of the substrate;

multiple electrically-conductive pads present on the first and second compliant members;

a surface-mount device mounted to the first and second compliant members, the surface-mount device comprising a chip formed of a second material having a lower coefficient of thermal expansion than the first material of the substrate; and

solder joints bonding the surface-mount device to the pads.

32. The circuit assembly according to claim 31, further comprising an aperture in the central region of the device attachment region.

33. The circuit assembly according to claim 32, wherein the aperture extends into each of the first and second compliant members.

34. The circuit assembly according to claim 32, wherein the aperture has a substantially rectilinear shape in the plane of the substrate.

35. The circuit assembly according to claim 32, wherein the aperture has a substantially circular shape in the plane of the substrate.

36. The circuit assembly according to claim 31, further comprising conductive runners that electrically interconnect the pads on the first and second compliant members to the second region of the substrate.

37. The circuit assembly according to claim 36, wherein each of the conductive runners extends along a surface of the substrate between the first and second slots.

38. The circuit assembly according to claim 36, wherein each of the first and second slots has an outward edge facing away from the device attachment region and an inward edge facing the device attachment region and delineating the peripheral border of its respective first or second compliant member, and the conductive runners extend toward the outward edges of the first and second slots, continuously follow the outward edges and then the inward edges of the first and second slots, and finally extend to the pads on the first and second compliant members.

39. The circuit assembly according to claim 31, wherein the first and second slots are filled with an electrically-nonconductive material that differs from the first and second materials.